PATENT ABSTRACTS OF JAPAN

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(54) MAGNETIC SUBSTANCE-INCLUDING PARTICLE AND ITS PRODUCTION METHOD, AND IMMUNOASSAY PARTICLE USING MAGNETIC SUBSTANCE-INCLUDING PARTICLE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a magnetic substance-including particles useful for immunoassay, having uniform magnetism and excellent dispersion stability with a narrow particle size distribution, its production method, and immunoassay particles using it.
SOLUTION: This magnetic substance-including particles formed of an organic high molecular material and a magnetic substance having an average particle size of 1-30 nm. The magnetic substance is included in the inner part in a dispersed state.

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CLAIMS

[Claim(s)]
[Claim 1]
The magnetic-substance endocyst particle which is a magnetic-substance endocyst particle which consists of an organic high polymer and the magnetic substance with a mean particle diameter of 1-30nm, and is characterized by containing said magnetic substance in the state of distribution in the interior.
[Claim 2]
The magnetic substance is a magnetic-substance endocyst particle according to claim 1 characterized by for a metal ion oxidizing and forming it inside a particle in the polymerization process in which a particle is made to form.
[Claim 3]
A metal ion is a magnetic-substance endocyst particle according to claim 2 characterized by being iron ion.
[Claim 4]
An organic high polymer is a magnetic-substance endocyst particle according to claim 1, 2, or 3 characterized by making into the main constituent the polymer which consists of an acrylic monomer.
[Claim 5]
An acrylic monomer is a magnetic-substance endocyst particle according to claim 4 characterized by being the monomer which has a glycidyl group.
[Claim 6]
An acrylic monomer is a magnetic-substance endocyst particle according to claim 4 characterized by being polyethylene-glycol (meta) acrylate expressed with the monomer and the following general formula which have a glycidyl group.
CH2=CR-COO-(CH2-CH2-O)n-H
(R expresses H or CH3 among a formula, and n expresses the integer of 2-20.)
[Claim 7]
The magnetic-substance endocyst particle according to claim 1, 2, 3, 4, 5, or 6 characterized by mean particle diameter being 0.05-1 micrometer.
[Claim 8]
The magnetic-substance endocyst particle according to claim 1, 2, 3, 4, 5, 6, or 7 characterized by the content of the magnetic substance being 0.1 - 40 % of the weight.
[Claim 9]
The process which carries out the polymerization of a hydrophobic monomer and/or the hydrophilic monomer, and forms a particle into a drainage system solvent.
It consists of a process which oxidizes said metal ion and forms the magnetic substance into said particle while incorporating a metal ion.
The manufacture approach of the magnetic-substance endocyst particle characterized by advancing to coincidence the process which forms said particle, and the process which forms said magnetic substance.
[Claim 10]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
Its particle size distribution is narrow while this invention has uniform magnetism, and it excels in distributed stability, and is related with the macromolecule particle which connotes the magnetic substance useful as a particle for immunoassay, its manufacture approach, and the particle for immunoassay using it.
[Background of the Invention]
[0002]
How to make contain iron ion in a macromolecule particle [finishing / (1) production] as a method of producing a magnetic-substance endocyst particle conventionally, and produce a magnetic-substance endocyst particle, (2) -- the approach (patent reference 1 reference) of including a magnetic-substance particle [finishing / production] in the process which carries out the polymerization of the particle from a monomer, and (3) -- the method (patent reference 2 reference) of making the macromolecule particle produced separately and a magnetic-substance particle compound-ize is learned. Moreover, in addition to this, there is the approach (patent reference 3 reference) of covering (4) magnetic-substance particle with a macromolecule etc.
[0003]
The magnetic substance was exposed to the front face, and the approach of (1) had the technical problem that the magnetic substance oxidized in order to make a macromolecule particle absorb iron ion. The approach of (2) had the technical problem that control of the technical problem that a magnetic-substance particle is not incorporated by homogeneity at a particle, or particle size was difficult, and served as a large object of particle size distribution. Since a macromolecule particle condensed the approach of (3), there was a technical problem that it could not be used in a particle with a small particle size. Since covering of the approach of (4) was impossible for homogeneity, it had the technical problem that floating and dispersibility may be bad and a part of magnetic-substance particle front face may be exposed.
[0004]
On the other hand, as minute amount immunoassay known from the former, radioimmunoassay, enzyme immunoassay, fluorescent immunoassay, etc. are already put in practical use. These approaches are approaches of detecting the existence of this, the antibody which reacts specifically, or an antigen using the antigen or antibody which added the isotope, the enzyme, and the fluorescent material as an indicator, respectively.
On the occasion of such immunoassay, the magnetic-substance endocyst particle is used in order to perform B/F separation efficiently and simple. Moreover, use other than B/F separation (patent reference 4 reference) and the immunoassay (patent reference 5, patent reference 6, and patent reference 7 reference) which uses the magnetic-substance endocyst particle itself as an indicator ingredient are indicated.
[0005]
[Patent reference 1] JP,9-208788,A

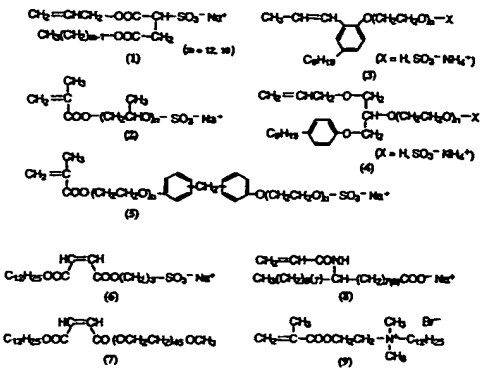
[Patent reference 2] JP,6-231957,A
[Patent reference 3] JP,6-92640,A
[Patent reference 4] JP,2000-88852,A
[Patent reference 5] JP,6-148189,A
[Patent reference 6] JP,7-225233,A
[Patent reference 7] ** table No. 524675 [2001 to] official report
[Description of the Invention]
[Problem(s) to be Solved by the Invention]
[0006]
Its particle size distribution is narrow while this invention has uniform magnetism in view of the above-mentioned present condition, and it excels in distributed stability, and aims at offering a magnetic-substance endocyst particle and its manufacture approach useful as an object for immunoassay, and the particle for immunoassay using it.
[Means for Solving the Problem]
[0007]
This invention is a magnetic-substance endocyst particle which consists of an organic high polymer and the magnetic substance with a mean particle diameter of 1-30nm, and is a magnetic-substance endocyst particle which contains the above-mentioned magnetic substance in the state of distribution in the interior.
This invention is explained in full detail below.
[0008]
The magnetic-substance endocyst particle of this invention consists of an organic high polymer and the magnetic substance with a mean particle diameter of 1-30nm.
The above-mentioned organic high polymer makes the main constituent the polymer which consists of a hydrophilic monomer for forming the shell of a macromolecule particle, forming the hydrophobic monomer for forming the core of a macromolecule particle, and/or the macromolecule particle underwater distributed to stability.
Since the distributed stability of the magnetic-substance endocyst particle which will be obtained if it is hard coming to incorporate the metal ion later mentioned during the grain child polymerization whose amount of the hydrophobic monomer in an organic high polymer decreases especially and the amount of a hydrophilic monomer decreases falls It is desirable to use these together, as for that rate, it is desirable that a hydrophobic monomer is [5 - 97 % of the weight and a hydrophilic monomer] 3 - 95 % of the weight, and it is more desirable to adjust suitably if needed in this range.
[0009]
<Hydrophobic monomer>
As the above-mentioned hydrophobic monomer, for example Styrene; alpha methyl styrene, Styrene derivative; vinyl chlorides, such as p-methyl styrene, p-chloro styrene, and chloro methyl styrene; Vinyl acetate, vinyl ester [, such as propionic-acid vinyl,]; -- unsaturated nitrile [, such as acrylonitrile]; (meta) -- a methyl acrylate -- An ethyl acrylate, butyl acrylate (meta), 2-ethylhexyl acrylate (meta), (Meta) Acrylic-acid stearyl, ethylene glycol (meta) acrylate, (Meta) Trifluoro ethyl (meta) acrylate, pentafluoro propyl (meta) acrylate, Acrylic ester (meta) derivatives, such as cyclohexyl (meta) acrylate, glycidyl methacrylate, and tetrahydrofurfuryl (meta) acrylate, etc. are mentioned. These monomers may be used independently and may use two or more sorts together.
[0010]
As the above-mentioned hydrophobic monomer, acrylic monomers, such as acrylic ester (meta) derivatives, such as a methyl acrylate (meta), an ethyl acrylate (meta), butyl acrylate (meta), 2-ethylhexyl acrylate (meta), acrylic-acid (meta) stearyl, ethylene glycol (meta) acrylate, trifluoro ethyl (meta) acrylate, pentafluoro propyl (meta) acrylate, cyclohexyl (meta) acrylate, glycidyl methacrylate, and tetrahydrofurfuryl (meta) acrylate, are used preferably.
[0011]
As the above-mentioned hydrophobic monomer, more preferably, in order to carry out synchronization of the particle formation and magnetic-substance formation by the

polymerization so that it may mention later, the acrylic monomer which has the glycidyl group excellent in the capacity to incorporate a metal ion during a particle polymerization at high concentration is used. That is, also in the above-mentioned acrylic monomer, since compatibility with iron ion and magnetite is high, especially glycidyl methacrylate (GMA) is used especially suitably.
[0012]
A cross-linking monomer can also be used as the above-mentioned hydrophobic monomer. As the above-mentioned cross-linking monomer, a divinylbenzene, divinylbiphenyl, divinyl naphthalene, ethylene GURIKORUJI (meta) acrylate, 1, 6-hexane JIORUJI (meta) acrylate, neopentyl GURIKORUJI (meta) acrylate, TORIMECHI roll pro pantry (meta) acrylate, tetra-methylol METANTORI (meta) acrylate, tetramethylol propane tetrapod (meta) acrylate, diallyl phthalate and its isomer, triallyl isocyanurate, its derivative, etc. are mentioned, for example. These cross-linking monomer may be used independently and may use two or more sorts together.
Also in this, since compatibility with iron ion and magnetite is high, ethylene GURIKORUJI (meta) acrylate is used suitably.
[0013]
<A hydrophilic monomer>
As the above-mentioned hydrophilic monomer, for example An acrylic acid, a methacrylic acid, The sulfonate which has the phosphoric ester; polymerization nature unsaturated bond which has the carboxylic-acid; polymerization nature unsaturated bond which has polymerization nature unsaturated bonds, such as an itaconic acid, a fumaric acid, and a maleic acid; The 4th class salt of dimethylaminoethyl methacrylate, salt [of an amine]; which has acryloyl radicals, such as the 4th class salt of diethylamino ethyl methacrylate, -- vinyl system monomer; which has cation radicals, such as a salt of the nitrogen-containing compound which has vinyl groups, such as vinylpyridine, -- 2-hydroxyethyl methacrylate -- Nonionic vinyl system monomers, such as polyethylene-glycol (meta) acrylate, acrylamide (meta), methylol acrylamide, and glycerol methacrylate (GLM), etc. are mentioned. These hydrophilic-properties monomer may be used independently and may use two or more sorts together. The polyethylene-glycol (meta) acrylate expressed with the following general formula also in this has the high capacity which distributes a particle to stability underwater, and since formation of the magnetic substance is not barred, it is used suitably.
CH2=CR-COO-(CH2-CH2-O)n-H
R expresses H or CH3 among a formula, and n expresses the integer of 2-20. The desirable minimum of n is 2 and a desirable upper limit is 10.
[0014]
As for the above-mentioned magnetic substance, it is desirable that a metal ion oxidizes and forms inside a particle in the polymerization process in which a particle is made to form.
<Metal ion>
Although the above-mentioned metal ion will not be limited especially if the magnetic substance is formed, they are iron ion, cobalt ion, nickel ion, etc., and is iron ion more preferably. With an oxidizer etc., the magnetite which is the magnetic substance oxidizes and ferric chloride is obtained.
[0015]
The mean particle diameter of the above-mentioned magnetic substance is 1-30nm. The magnetic response characteristic of the magnetic substance decreases that it is less than 1nm, when it is used for immunoassay, sensitometry falls, and it is hard coming to carry out quality and quantitative analysis. Moreover, if it exceeds 30nm, the dispersibility within a magnetic-substance endocyst particle falls, and magnetism becomes an ununiformity, and it will be hard coming to carry out quality and quantitative analysis, when it is used for immunoassay also in this case. A desirable minimum is 2nm and a desirable upper limit is 20nm. Furthermore, it becomes possible to form the minute magnetic substance by carrying out synchronization of the process which oxidizes a metal ion and forms the magnetic substance, incorporating in a particle the process and metal ion which form a particle like [although a desirable upper limit is 10nm

and it is usually difficult to form such a minute magnetic-substance particle] the manufacture approach mentioned later.
[0016]
The magnetic-substance endocyst particle of this invention contains the above-mentioned magnetic substance in the state of distribution in the interior. That is, in the magnetic-substance endocyst particle of this invention, it exists in the condition of having distributed inside the particle, without the magnetic substance being exposed to a particle front face.
[0017]
As for the magnetic-substance content of the magnetic-substance endocyst particle of this invention, it is desirable that the polymerization presentation adjusts in 0.1 - 40% of the weight of the range. The magnetic response characteristic of a magnetic-substance endocyst particle decreases that it is less than 0.1 % of the weight, when it is used for immunoassay, sensitometry falls, and it is hard coming to carry out quality and quantitative analysis. Moreover, if it exceeds 40 % of the weight, the polymerization operability of a particle will fall and it will be hard coming to incorporate a metal ion during a particle polymerization. A desirable minimum is 1 % of the weight, and a desirable upper limit is 30 % of the weight.
[0018]
As for the mean particle diameter of the magnetic-substance endocyst particle of this invention, it is desirable that the polymerization condition adjusts in 0.05-1 micrometer. When it exceeded less than 0.05 micrometers and 1 micrometer, was hard coming to carry out control and polymerization actuation of the particle shape of a magnetic-substance endocyst particle, and it applied to immunoassay in less than 0.05 micrometers, and sensitometry falls, is hard coming to carry out quality and quantitative analysis, it exceeded 1 micrometer and it applies to immunoassay, in dispersion liquid, it passes by condensation, a particle becomes easy to sediment by the time, and it is hard quality and quantitative analysis coming to carry out also in this case. A desirable minimum is 0.07 micrometers and a desirable upper limit is 0.8 micrometers.
[0019]
The magnetic-substance endocyst particle of this invention consists of a process which carries out the polymerization of a hydrophobic monomer and/or the hydrophilic monomer, and forms a particle into a drainage system solvent, and a process which oxidizes the above-mentioned metal ion and forms the magnetic substance while incorporating a metal ion in the above-mentioned particle, and is manufactured by the approach of advancing to coincidence the process which forms the above-mentioned particle, and the process which forms the above-mentioned magnetic substance. Such a manufacture approach is also one of this inventions.
[0020]
In the process which carries out the polymerization of a hydrophobic monomer and/or the hydrophilic monomer, and forms a particle into a drainage system solvent, it is desirable to add a polymerization initiator.
<Polymerization initiator>
It is not limited especially as the above-mentioned polymerization initiator, for example, a water-soluble organic azo compound, an inorganic peroxide, organic peroxide, etc. are mentioned.
As a suitable example of the above-mentioned polymerization initiator, potassium persulfate (KPS; polymerization temperature of 70 degrees C), azobis amidinopropane hydrochloride (V-50; polymerization temperature of 70 degrees C), 2, and 2-azobis [2-(2-imidazoline-2-IRU) propane] dihydrochloride (VA-044; polymerization temperature of 60 degrees C) etc. is mentioned. Among these, KPS which is a peroxide system polymerization initiator expects to contribute to oxidation of divalent iron ion with polymerization initiation, and assumes the synchronization of the polymerization and magnetite generation by the monomer and iron ion. Moreover, V-50 and VA-044 have weak oxidizing power, and it becomes the polymerization initiator which participates in loose oxidation reaction of divalent iron ion.
Since the above-mentioned polymerization initiator may lose radical activity by the consumption and Fe3+ by oxidization of Fe2+, it is the purpose to which the particle growth by the polymerization is urged, and it is effective to carry out adding after mixing to a particle growth

process. In this case, a new secondary particle is not formed but a particle front face is covered with a polymer.
[0021]
<pH regulator>
In forming the magnetic substance in a polymerization and coincidence, in this invention, it becomes important to adjust pH in a polymerization system to basicity. For example, although underwater distributed stability is good as a merit and the narrow monodisperse particle of particle size distribution is obtained by the system using KPS as a polymerization initiator, since control of oxidizing power cannot be performed as a demerit but the inside of a polymerization system becomes acidity, the magnetic-substance endocyst particle obtained may turn into a weak particle of how to a magnet to be able to draw near. On the other hand, the merit in the system using VA-044 which do not have oxidizing power as a polymerization initiator is that pH in a polymerization system is neutrality mostly.
In order to maintain pH in a polymerization system at weak base nature, the general base as a pH regulator can be used. NH4OH is suitably used as a pH regulator.
The above-mentioned pH regulator can be added several times if needed.
[0022]
<Polymerization method>
Although particle polymerization methods, such as a suspension polymerization, a distributed polymerization, an emulsion polymerization, and a soap free emulsion polymerization, can be used for the magnetic-substance endocyst particle of this invention, since it is desirable that it is 5% or less, the Cv value of the magnetic-substance endocyst particle obtained is suitably manufactured according to the soap free emulsion polymerization excellent in control of particle size distribution.
Although the manufacture approach of the magnetic-substance endocyst particle by the soap free emulsion polymerization is illustrated hereafter, it is not limited to this approach.
[0023]
The typical polymerization presentation is as follows.
The monomer constituent which consists of a hydrophilic monomer / a hydrophobic monomer / a reactant emulsifier: 3g
H2O:100g
Weighing capacity of the above-mentioned monomer constituent and the water is carried out to a 4 opening flask. A stirring rod and a reflux cooling pipe are attached in each opening. Next, in the system using KPS and V-50 as a polymerization initiator, by the system which uses VA-044 [70-degree C], it puts into a 50 degrees C - 60 degrees C thermostat, and the nitrogen purge of the inside of a system is carried out, stirring. Then, the polymerization initiator melted in water is poured in into a system with a glass syringe. This time is considered as polymerization initiation and the water solution of FeCl2.4H2O which uses a glass syringe and serves as a source of magnetism is poured in after predetermined time. FeCl2.4H2O uses what melted 1 / three to 4 time mol of a polymerization initiator in 5g of water. That is, while starting the polymerization of an above-mentioned monomer by the polymerization initiator, a magnetic-substance endocyst particle is manufactured by oxidizing divalent iron ion (magnetite-izing).
As for a polymerization, it is desirable to carry out from initiation for 2 hours to 24 hours. In order to obtain moderate oxidizing power, NH4OH may be added in the middle of a polymerization, and further, in order to urge growth of the particle by the polymerization, a polymerization initiator may be added in the middle of a polymerization. Thus, the magnetic-substance endocyst particle which is a macromolecule particle which connoted the magnetic substance can be obtained.
[0024]
The above-mentioned reactant emulsifier is a copolymerization monomer, and may be added if needed.
<A reactant emulsifier>
As the above-mentioned reaction emulsifier, the reactant emulsifiers expressed with the following general formula are mentioned, for example, and these reactivity emulsifier may be used

independently and may use two or more sorts together.
[0025]
[Formula 1]



[0026]
The obtained magnetic-substance endocyst particle is refined by repeating centrifugal seperation and re-distribution with distilled water, and performing it, in order to remove a residual monomer, a polymerization initiator, unreacted iron ion, etc. After performing centrifugal separation, a supernatant is thrown away by the decantation, distilled water is added, and a glass rod performs re-distribution. It moves to a glass vial after purification, and seals and saves by the cover and parafilm.
[0027]
The magnetic-substance endocyst particle of this invention is very suitable for immunoassay, and can obtain the particle for immunoassay by adsorbing or combining an antigen or an antibody with a magnetic-substance endocyst particle. Such a particle for immunoassay is also one of this inventions.
It is not limited especially as an approach of adsorbing or combining an antibody or an antigen with the magnetic-substance endocyst particle of this invention, for example, well-known approaches, such as a physical-adsorption method and a chemical bond method using a carbodiimide, can be used.
[0028]
The magnetic-substance endocyst particle of this invention or the particle for immunoassay of this invention can be used suitable for immunoassay.
As the above-mentioned immunoasssay, well-known approaches, such as radioimmunoassay which used the magnetic-substance endocyst particle as ****, and enzyme immunoassay, are mentioned, for example, and the antigen or antibody made into the purpose can be measured by the sandwich technique or the competing method. Moreover, the isotope which is the marker of

the above-mentioned approach, an enzyme, etc. can use a magnetic-substance endocyst particle as an indicator instead of.
[0029]
Since the magnetic-substance endocyst particle of this invention is a narrow particle of the particle size distribution which carries out distributed content of the magnetic substance at homogeneity, it can measure the magnetic substance with sufficient sensibility to a precision in the immunoassay used as an indicator by using the magnetic-substance endocyst particle of this invention. Namely, the particle for immunoassay which combined with the magnetic-substance endocyst particle the antigen or antibody which it is going to measure, the antibody which reacts specifically, or the antigen is used. After making this particle for immunoassay, the antigen which it is going to measure, or an antibody react, the antigen or antibody which it is going to measure can be measured qualitatively and quantitatively by measuring the magnetic amount of the magnetic-substance endocyst particle in the particle for immunoassay which reacted.
[Effect of the Invention]
[0030]
Since the magnetic-substance endocyst particle of invention according to claim 1 contains the magnetic substance with a mean particle diameter of 1-30nm inside, while excelling in the magnetic response characteristic of the magnetic substance, it excels in a magnetic response characteristic, and it excels also in the dispersibility of the magnetic substance within a magnetic-substance endocyst particle, namely, particle size is [particle size distribution is also narrow and] magnetism is uniform and still more uniform [a magnetic-substance endocyst particle]. Therefore, immunoassay can be quantitatively performed only in addition to a qualitative target with the outstanding sensitometry by being able to use it suitably as an object for immunoassay as which sensitometry etc. is required, and measuring the magnetism of the magnetic-substance endocyst particle which contributed to the immunoreaction in immunoassay. Moreover, since the front face is formed from the organic high polymer, an antigen or an antibody can be combined certainly.
Inside a particle, since iron ion oxidizes and is formed preferably, the magnetic substance is incorporated by certain in a magnetic-substance endocyst particle, and homogeneity, and, as for the magnetic-substance endocyst particle of invention according to claim 2, and the magnetic-substance endocyst particle of invention according to claim 3, the magnetic substance can discover certainly a metal ion and the sensitometry required of immunoassay.
The magnetic-substance endocyst particle of invention according to claim 4 can carry out synchronization of the particle formation and magnetic-substance formation by the polymerization certainly while particle formation by the polymerization is ensured, since the organic high polymer which constitutes a magnetic-substance endocyst particle is an acrylic monomer. Therefore, a magnetic-substance endocyst particle can have uniform magnetism, and particle size distribution can also be narrow, and the sensitometry which was more excellent in immunoassay can be discovered.
Since the magnetic-substance endocyst particle of invention according to claim 5 is an acrylic monomer in which the organic polymeric material which constitutes a magnetic-substance endocyst particle has a glycidyl group, it excels in compatibility with suitable iron ion and magnetite to form the magnetic substance, therefore a magnetic-substance endocyst particle becomes that by which the magnetic substance was distributed more by homogeneity, and the sensitometry required of immunoassay becomes what was more excellent.
Since the magnetic-substance endocyst particle of invention according to claim 6 is the combination of the hydrophobic acrylic monomer of specification [an organic high polymer] and the hydrophilic acrylic monomer which constitute a magnetic-substance endocyst particle It is not only easy to incorporate a metal ion to homogeneity during a particle polymerization, but it excels in the distributed stability of a magnetic-substance endocyst particle. Therefore, in dispersion liquid, it can pass by condensation, and a particle cannot sediment by the time, excessive processes, such as sonication, cannot be needed, but the sensitometry which was excellent in immunoassay etc. can be discovered.
Since mean particle diameter is 0.05-1 micrometer, it is easy to carry out polymerization

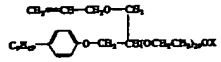
actuation, namely, as for the magnetic-substance endocyst particle of invention according to claim 7, the above magnetic-substance endocyst particles are obtained certainly.
Since the content of the magnetic substance is 0.1 - 40 % of the weight, the magnetic-substance endocyst particle of invention according to claim 8 can discover the outstanding magnetic response characteristic uniformly and certainly, and can apply it suitably with immunoassay. Moreover, it is easy to carry out polymerization actuation, and the above magnetic-substance endocyst particles are obtained certainly.
Since the manufacture approach of invention according to claim 9 to 13 carries out synchronization of the process which forms the magnetic substance for the process which forms a particle, it can obtain the above-mentioned magnetic-substance endocyst particle easily and certainly.
Since the magnetic-substance endocyst particle which is support contains the magnetic substance with a mean particle diameter of 1-30nm inside, it excels in a magnetic response characteristic, and magnetism is uniform and particle size is [particle size distribution is also narrow and] still more uniform [the particle for immunoassay of invention according to claim 14]. Moreover, since the front face is formed by the organic high polymer, the antigen or the antibody is combined certainly. Therefore, it can be used suitable for the immunoassay with which sensitometry etc. is demanded, and immunoassay can be quantitatively performed only in addition to a qualitative target with the outstanding sensitometry by measuring the magnetism of the magnetic-substance endocyst particle in the particle for immunoassay which contributed to the immunoreaction in immunoassay.
[Best Mode of Carrying Out the Invention]
[0031]
Although an example is hung up over below and this invention is explained to it in more detail, this invention is not limited only to these examples.
[0032]
(Examples 1-7)
Weighing capacity of the various monomers and 90g of water shown in Table 1 was carried out to the 200ml 4 opening flask. A stirring seal, a stirring rod, a reflux cooling pipe, and Ceram rubber were attached in each opening. The system was put into the 70-degree C thermostat, and the nitrogen purge of the inside of a system was carried out for 30 minutes, stirring by 200rpm. Then, KPS which is the polymerization initiator melted in water 0.06g was dissolved in 10g water, and it poured in into the system with the glass syringe. This time was considered as polymerization initiation, after 2 minutes, the glass syringe was used and the FeCl2.4H2O water solution of the specified quantity was poured in. The polymerization was performed from polymerization initiation for 20 hours. In order to obtain moderate oxidizing power, it is NH4OH in the middle of a polymerization. 0.165g was added.
The produced particle was refined by repeating centrifugal separation and re-distribution 4 times, and performing it with distilled water. Under the present circumstances, centrifugal separation was performed by 20 degrees C and 13500rpm. After performing centrifugal separation, the supernatant was thrown away by the decantation, distilled water was added, the glass rod performed re-distribution, and the magnetic-substance endocyst particle was obtained.

[0033]
[Table 1]

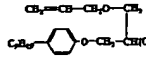
実施例	GMA	EGDM	AAm	PE-90	PE-350	NE-20	SE-20	$FeCl_2 \cdot 4H_2O$
1	2.835	0.015	0.15	–	–	–	–	0.033
2	2.835	0.015	–	0.15	–	–	–	0.176
3	2.685	0.015	–	0.30	–	–	–	0.176
4	2.835	0.015	–	–	0.15	–	–	0.176
5	2.685	0.015	–	–	0.30	–	–	0.176
6	2.835	0.015	0.05	–	–	0.15	–	0.088
7	2.835	0.015	0.15	–	–	–	0.06	0.176

(単位：g)

[0034]
The publication of front Naka is as follows.
GMA: Glycidyl methacrylate
EGDM: Ethylene glycol dimethacrylate
AAm: Acrylamide
PE-90: Polyethylene-glycol methacrylate (n= 2)
PE-350: Polyethylene-glycol methacrylate (n= 8)
NE-20:
[0035]
[Formula 2]



[0036]
(X expresses H among a formula.)
[0037]
SE-20:
[0038]
[Formula 3]



[0039]
(X expresses SO4NH4 among a formula.)
[0040]
About the obtained magnetic-substance endocyst particle dispersion liquid, the distributed condition of a particle was observed visually. Moreover, the refined magnetic-substance endocyst particle was diluted with water, self-possessed immobilization was carried out on the collodion membrane supported in a metal mesh, and the gestalt of a particle was observed with the transmission electron microscope (TEM).
[0041]
The aggregate was accepted in part, and since the example 1 was a little low thing of the

distributed stability at which a particle sediments as time amount passed, sonication re-distributed it. On the other hand, the aggregate was accepted by neither but, as for the examples 2-5 using polyethylene-glycol methacrylate as a hydrophilic monomer, and the examples 6 and 7 using a reactant emulsifier, the particle with high distributed stability was obtained. Especially the examples 6 and 7 using a reactant emulsifier had a small grain size, and it was admitted that distributed stability was excellent. Moreover, it was observed inside the particle that the particle of examples 1-7 is all a profile with a beautiful particle front face including the magnetic substance. The TEM photograph (mean particle diameter; 0.21 micrometers of magnetic-substance endocyst particles, 5nm of magnetic substance) of the magnetic-substance endocyst particle of an example 2 was shown in drawing 1 .
[0042]
It checked by viewing that the produced magnetic-substance endocyst particle (examples 1-7) was suitably diluted with little picking and distilled water in a 1.5ml micro tube as a check of being able to draw near to a magnet, stood a tube to micro tube **** (the product made from DYNAL, MPC(trademark)_M) with a magnet, and the particle currently distributed could draw it near to a magnet. It was imagined that especially the examples 2-5 using polyethylene-glycol methacrylate as a hydrophilic monomer have large magnetism compared with other examples. The mean particle diameter of the magnetic substance of the magnetic-substance endocyst particle in each example was shown in Table 2.
[0043]
[Table 2]

実施例	平均粒径(nm)
1	5
2	5
3	6
4	6
5	8
6	3
7	5

[0044]
(Example 8)
Weighing capacity of the various monomers and water which are shown in a 200ml 4 opening flask below was carried out.
AAm/GMA/EGDM/H2O=0.15/2.835/0.015/90(g
A stirring seal, a stirring rod, a reflux cooling pipe, and Ceram rubber were attached in each opening. The system was put into the 70-degree C thermostat, and the nitrogen purge of the inside of a system was carried out for 30 minutes, stirring by 200rpm. Then, KPS which is the polymerization initiator melted in water 0.08g was dissolved in 10g water, and it poured in into the system with the glass syringe. This time was considered as polymerization initiation, after predetermined time, the glass syringe was used and the FeCl2.4H2O water solution (FeCl2.4H2O 0.165g is dissolved in 5g of water) was poured in. In order to obtain moderate oxidizing power after [of polymerization initiation] 1 minute, NH4 OH/H2O=0.165/5(g) was added, and the polymerization was performed for 2 hours.
[0045]
The produced particle was refined by repeating centrifugal separation and re-distribution 4 times, and performing it with distilled water. Under the present circumstances, centrifugal separation was performed by 20 degrees C and 13500rpm. After performing centrifugal separation, the supernatant was thrown away by the decantation, distilled water was added, the glass rod performed re-distribution, and the magnetic-substance endocyst particle was obtained.

[0046]
(Example 9)
The magnetic-substance endocyst particle was obtained like the example 8 after polymerization initiation except having added the following matter to predetermined time, and polymerization time amount being 3 hours.
After [of polymerization initiation] 30 minutes NH4 OH/H2O=0.165 / 5 (g)
After [of polymerization initiation] 60 minutes KPS/H2O=0.165 / 5 (g)
[0047]
(Example 10)
The magnetic-substance endocyst particle was obtained like the example 8 after polymerization initiation except having added the following matter to predetermined time, and polymerization time amount being 3 hours.
After [of polymerization initiation] 60 minutes KPS/H2O=0.165/5(g) FeCl2.4H2 O/H2O=0.088 / 5 (g)
After [of polymerization initiation] 120 minutes GMA=0.5(g) NH4 OH/H2O=0.165 / 5 (g)
[0048]
(Example 11)
The magnetic-substance endocyst particle was obtained like the example 8 after polymerization initiation except having added the following matter to predetermined time, and polymerization time amount being 4 hours.
After [of polymerization initiation] 1 minute NH4 OH/H2O=0.165 / 5 (g)
After [of polymerization initiation] 120 minutes KPS/H2O=0.165 / 5 (g)
[0049]
Gestalt observation of the particle by TEM was performed to the obtained magnetic-substance endocyst particle (examples 8-11).
As for examples 9 and 10, it was admitted by each that particle size was increasing including many magnetic substance rather than the example 8. Moreover, in the example 11, it was observed including the magnetic substance comparable as examples 9 and 10 inside that a particle front face is a beautiful profile. It was guessed that adding NH4OH in the phase where particle growth is quicker than an old experiment is the factor which checks growth. On the other hand, it was checked that it is observed that conversion becomes about 100%, a secondary particle is not formed, but the particle front face is covered by the polymer, and the adding after mixing of a polymerization initiator is an effective means. The mean particle diameter of the magnetic substance of the magnetic-substance endocyst particle in each example was shown in Table 3.
[0050]
[Table 3]

実施例	平均粒径(nm)
8	8
9	8
10	10

[0051]
Furthermore, the particle for immunoassay was produced from the magnetic-substance endocyst particle obtained in the example 2, and immunoassay was performed.
(Production of the particle for immunoassay)
6ml (100 mmol/l, pH7.5) of phosphate buffer solutions was added to 30mg of magnetic-substance endocyst particles obtained in the example 2, and at-long-intervals alignment separation was performed in 15000rpm for 20 minutes. 1ml of solutions which dissolved the anti-HBsAg monoclonal antibody in the phosphate buffer solution (100 mmol/l, pH7.5) so that it might become the concentration of 0.25mg/ml was added to the obtained dregs, and churning mixing

was carried out at the room temperature for 20 hours. Then, in order to remove an unreacted anti-HBsAg monoclonal antibody, at-long-intervals alignment separation was performed in 15000rpm for 20 minutes, 6ml (100 mmol/l, pH7.5) of phosphate buffer solutions was made to suspend the obtained dregs further, and at-long-intervals alignment separation was again performed in 15000rpm for 20 minutes. Then, 6ml of solutions which dissolved in the phosphate buffer solution (100 mmol/l, pH7.5) so that it might become 1% of the weight of concentration was made to suspend cow serum albumin, the obtained dregs were agitated at the room temperature for 1 hour, blocking processing was performed, and the particle for immunoassay by which the anti-HBsAg monoclonal antibody was combined with the magnetic-substance endocyst particle was obtained.
Next, in order to carry out refrigeration preservation of the obtained particle for immunoassay, 6ml of solutions which performed at-long-intervals alignment separation in 15000rpm for 20 minutes, dissolved the obtained dregs in the phosphate buffer solution (100 mmol/l, pH7.5) so that the concentration of cow serum albumin might become 1% of the weight, and dissolved the sodium azide further so that it might become 0.01% of the weight of concentration was made to suspend, and refrigeration preservation was carried out immediately.
[0052]
(Production of a test piece)
The nitrocellulose membrane (SRHF, Nihon Millipore make) was judged in width-of-face [of 30cm] x die length of 6cm, and the solution which dissolved the anti-HBsAg monoclonal antibody which has a different reaction epitope from what was used for the 3cm part (reactive site) by the above-mentioned particle for immunoassay in the tris hydrochloric-acid buffer solution (10 mmol/l, pH7.4) so that it might become the concentration of 2.0mg/ml was applied from the die-length direction upper limit with a width of face of 0.7mm in the shape of a straight line. Then, after drying at 37 degrees C for 2 hours, it was immersed in the solution which dissolved cow serum albumin (Wako Pure Chem make) in the phosphate buffer solution (100 mmol/l, pH7.5) so that it might become 1% of the weight of concentration for 1 hour, and blocking processing was performed. Furthermore, after that, lauryl benzenesulfonic acid sodium was dried under the room temperature after washing and within the silica gel desiccator with the solution which dissolved in the phosphate buffer solution (100 mmol/l, pH7.5) so that it might become 0.1% of the weight of concentration, and the anti-HBsAg monoclonal antibody fixed film was obtained.
The obtained anti-HBsAg monoclonal antibody fixed film was cut out in width of face of 5mm, the filter paper for water absorption with a width-of-face [of 5mm] x die length of 2cm (Nihon Millipore make) was put on the die-length direction upper limit, and it fixed on the transparent tape, and considered as the test piece.
[0053]
(Operation of immunoassay)
The solution which dissolved the above-mentioned particle for immunoassay in the phosphate buffer solution (100 mmol/l, pH7.5) so that it might become 0.1% of the weight of concentration, dissolved cow serum albumin further so that it might become 1% of the weight of concentration, and dissolved the sodium azide further so that it might become 0.01% of the weight of concentration was produced, and 20micro of these solutions I was added to each well of 96 well microplate (NARUJIENUNKUINTA National make).
Next, the HBs antigen reference standard (50 IU/ml) was diluted with the phosphate buffer solution (100 mmol/l, pH7.5) so that it might become predetermined concentration, respectively. 100microl was put in after addition mixing and the test piece was put in in the well at the well, and it stood so that a standing position might be carried out.
In the place and reactive site which took out the test piece, the magnetism according to HBs antigen concentration was checked after 30 minutes, and the useful thing was shown in the immunoassay which uses magnetism as an indicator.
[Brief Description of the Drawings]
[0054]
[Drawing 1] It is the TEM photograph of the magnetic-substance endocyst particle (mean

particle diameter; 0.21 micrometers of magnetic-substance endocyst particles, 5nm of magnetic substance) of an example 2.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[0054]
[Drawing 1] It is the TEM photograph of the magnetic-substance endocyst particle (mean particle diameter; 0.21 micrometers of magnetic-substance endocyst particles, 5nm of magnetic substance) of an example 2.

[Translation done.]